CASE REPORT

Bilateral buccal radicular groove in maxillary incisors: case report

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Abstract

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Aim To present the rare localization of a radicular groove on the buccal aspect of a tooth and to discuss the pathology and management of the concomitant endo-periodontal defect.

Summary Bilateral buccal radicular grooves were found on the maxillary central incisors of a 60-year-old female Caucasian. One groove was associated with deep local pocketing resulting in pulp necrosis and the formation of a periodontal–endodontic lesion. After endodontic treatment of the affected tooth, periodontal surgery was performed during which an apicoectomy was carried out on the root-filled tooth. Both the buccal grooves were removed by grinding, the roots were planed with curettes and a guided-tissue regeneration technique applied using amelogenin (Emdogain, Biora, Sweden). Following a period of 2 years, re-examination showed excellent healing with the complete elimination of the periodontal pocket on both incisors and significant radiographic evidence of bone regeneration.

Key learning points

- Deep radicular grooves can predispose to pulp necrosis and the establishment of combined periodontal–endodontic lesions.
- Evaluation of clinical signs and appropriate diagnostic tests are of paramount importance in order to prevent incorrect diagnosis and treatment.
- Endodontists must be capable of performing advanced periodontal regeneration techniques during endodontic surgery.

Keywords: facial radicular groove, periodontal regeneration, periodontal–endodontic lesions.

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Introduction

A mild dental anomaly occurring in the region of maxillary incisors is the radicular palatal groove. This malformation is also described in the dental literature as a disto-lingual groove, a radicular lingual groove, a palato-gingival groove or a radicular anomaly (Everett & Kramer

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1972, Gao *et al.* 1989). As the name implies, this malformation is actually a groove, which starts near the cingulum of the tooth and runs towards the cemento-enamel junction in an apical direction at various depths along the root surface.

The exact aetiology of this defect is not fully understood. Some clinicians believe that the radicular groove represents the mildest form of dens invaginatus and, therefore, the pathogenetic mechanism is relatively common. This means that there is minimal in-folding of the enamel organ and the epithelial sheath of Hertwig during odontogenesis (Lee *et al.* 1968, Everett & Kramer 1972). Other investigators claim that this malformation results from an attempt of the body to form another root on the affected tooth (Simon *et al.* 1971, Peikoff *et al.* 1985). Withers *et al.* (1981) reported that around 8.5% of the population suffer from a defect resembling a radicular palatal groove, while others have found it in only 2.8–3% (Kovacs 1971, Peikoff & Trott 1977). However, the incidence is higher (>18%) in Chinese populations, indicating a racial link (Hou & Tsai 1993).

The majority of the radicular grooves are seen at the palatal aspect of maxillary lateral or central incisor and rarely in the posterior teeth (Benenati 1985). Among the incisors, the maxillary lateral incisor is the most commonly affected tooth (94% of cases compared with 6% for central incisors; Everett & Kramer 1972, Bacic *et al.* 1990). Buccal location of a radicular groove is very rare; only two cases of incisors with buccal radicular grooves have been reported in the dental literature (Kozlovsky *et al.* 1988, Goon *et al.* 1991). There have been no previous reports, describing bilateral location of buccal radicular grooves. In this report, a clinical case is presented in which buccal radicular grooves on central incisors were associated with the formation of periodontal pockets, bone loss and pulp necrosis.

Case report

A 60-year-old Caucasian female was admitted to the Endodontic Emergency Clinic of the University of Athens on 24 October 1998, complaining of a severe pain and swelling in the maxillary incisor region. The symptoms had appeared 3 days before, and the patient received analgesics and antibiotics for pain relief. Relevant medical history included an idiopathic neutropenia. The patient reported no history of trauma or injurious habits to her teeth and had not received orthodontic treatment. Oral hygiene was poor with generalized moderate periodontitis and soft-tissue inflammation. A prominent labial fraenum was observed, but there were no signs of fraenum-pull phenomenon. There was, however, a diffuse swelling in the attached gingiva of the anterior maxilla. Periodontal probing around the maxillary incisors revealed local pocketing almost to the apex on the mid-buccal region of tooth 21. Initially, it was thought that the patient was suffering from a periodontal abscess. However, there were no signs of advanced periodontitis, suggesting a local problem. Moreover, sensitivity tests (both thermal and electrical) suggested pulp necrosis in tooth 21, while the pulpal response of tooth 11 was within normal limits. The crown of both incisors was intact, but after careful inspection of the buccal cervical area, each central incisor had a slight notch (Fig. 1). The gingiva in this area was oedematous, but well adapted to the crown concavity. Manual probing of tooth 21 indicated that the concavity crossed the cemento-enamel junction, extending to the root in the form of a groove (Fig. 2).

Radiographic examination showed vertical bone loss associated with the mesial aspect of tooth 21, as well as a small apical rarefaction on the same tooth. The radicular groove could not be distinguished on the radiograph. The bone level around the right incisor (tooth 11) was normal (Fig. 3).

Diagnosis was of a combined periodontal–endodontic lesion, with periodontal breakdown associated with a buccal radicular groove and concomitant pulp necrosis. As the

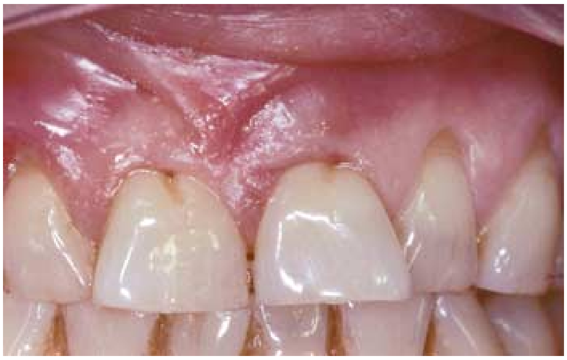

Figure 1 Maxillary central incisors after resolution of acute symptoms. Discrete notches are evident in the mid-labial region at the cervical margin of tooth 11 and tooth 21.

depth of the groove in the area of the free gingiva was not substantial, it was decided to treat the patient first by performing root canal treatment on tooth 21 combined with subgingival curretage and root planing. The endodontic and periodontal treatment were completed on 12 November 1998, and the patient was advised to return 2 months later for evaluation. During endodontic treatment of tooth 21, vital pulpal tissue was not detected. Re-examination revealed that the pocket depth had not improved, and the patient was therefore scheduled for surgical exploration. After administering antibiotics (Amoxil, 500 mg every 8 h), starting 1 day before operation, an apically positioned full-thickness flap was raised to expose the angular bony defect. The labial bone of tooth 21 was completely resorbed towards the apex of the tooth. The buccal radicular groove on the same tooth extended almost to the apex; while the groove on tooth 11 did not reach such length (Fig. 4). After removing the pathological granulation tissues, the gutta-percha cone was seen to extrude through the apical foramen of tooth 21, and an apicoectomy was therefore performed. The radicular groove on both incisors was reduced by grinding, and the root surface was planed with curettes (Fig. 5). As bone loss was extensive and the dentine had been exposed on the root surface, it was decided to use amelogenin (Emdogain, Biora, Sweden). This is a novel product, which encourages the regeneration of all periodontal tissues, namely, the apposition of new acellular extrinsic cementum, which is firmly attached to the underlying dentine, as well as regeneration of the periodontal ligament and alveolar bone (Hammastrom *et al*. 1997). According to the manufacturer's instructions, the sutures were prepositioned, the root was cleaned and kept dry. Finally,

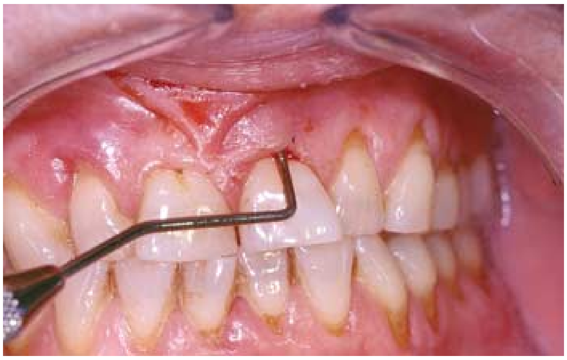

Figure 2 Periodontal examination of tooth 21. Note the deep periodontal pocket.

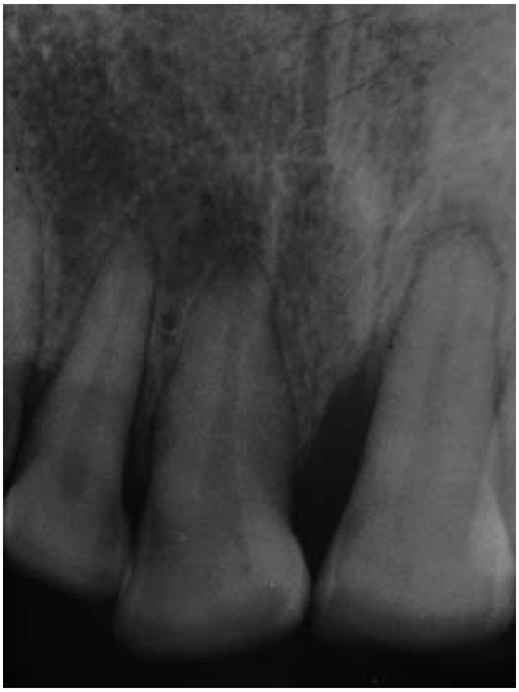

Figure 3 Radiograph of teeth 11–21. An angular bony defect as well as an apical rarefaction are seen at the mesial aspect of tooth 21.

Emdogain gel was applied (Fig. 6). Conditioning of the root was not performed with acid. After suturing the surgical wound, the patient was advised to continue the course of antibiotics for 1 week, and to use chlorhexidine gluconate 0.12% to supplement oral hygiene. Sutures were removed after 2 weeks because of apparent delayed healing at 1-week post-operation. Re-examination 2 years later showed excellent recovery (Fig. 7), with labial probing depths of only 2 mm (Fig. 8). There was post-operative gingival recession of approximately 3 mm and minor gingival inflammation without further loss of clinical attachment. Radiographic examination showed complete bone regeneration in the apical area of the tooth and return to almost normal levels at the mesial aspect of the tooth (Fig. 9).

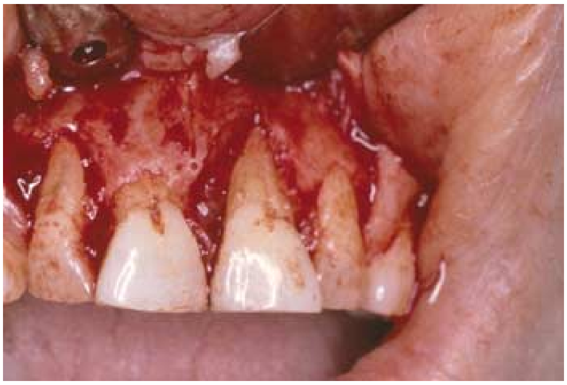

Figure 4 Flap elevation exposing the grooves on both incisors. Note the bone destruction on the mesial and buccal aspect of tooth 21.

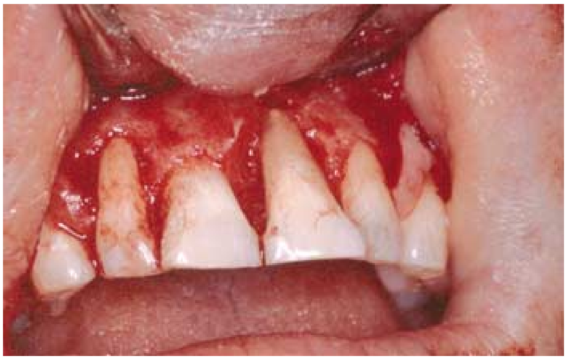

Figure 5 The same teeth after elimination of the radicular grooves, smoothing of the roots and apicoectomy of tooth 21.

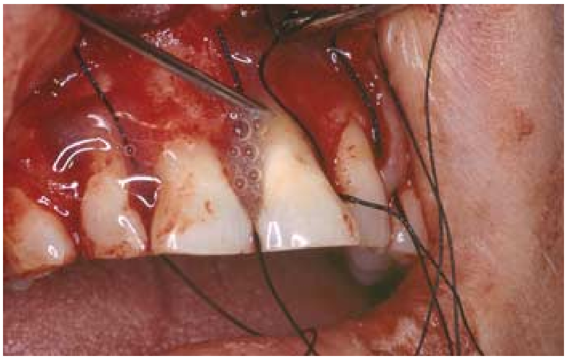

Figure 6 Application of the gel of Emdogain on exposed root surfaces after placing the sutures.

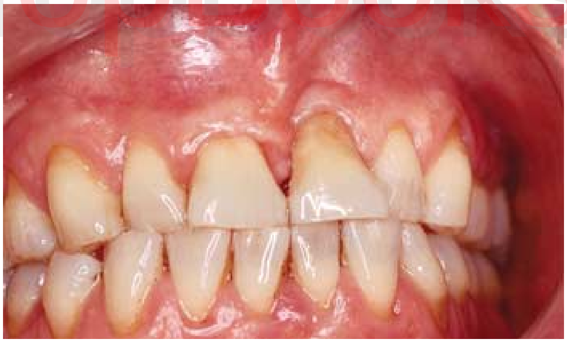

Figure 7 Re-examination of the patient after 2 years. Note the excellent healing and the absence of gingival inflammation.

Discussion

An unusual case of radicular grooves on the buccal aspect of two maxillary central incisors and detailed treatment of an associated severe periodontal–endodontic problem has been presented.

Scanning electron microscopy of teeth with radicular palatal grooves has found that the deepest part of the groove is usually in the cervical region, although sometimes it may occur more apically (Gao *et al.* 1989). In severe cases, the histological findings are more

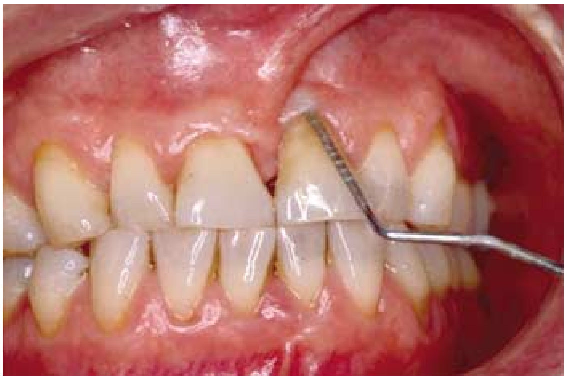

Figure 8 Periodontal examination revealed no significant probing depths on either incisors.

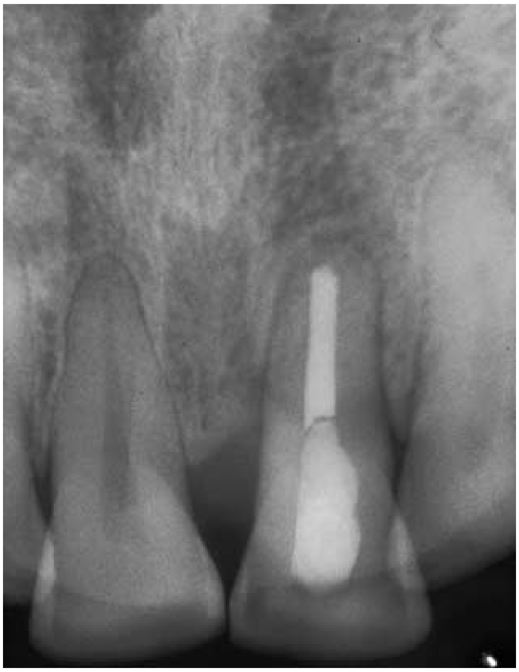

Figure 9 Radiographic examination of the central incisors revealed significant bone regeneration proximally of tooth 21.

distinctive. Dysplastic radicular dentine with numerous clefts are often encountered along the length of the defect, while in deeply invaginated cases, there may be a groove with entrapped enamel within a 'blind cul-de-sac'(Everett & Kramer 1972). For these anatomical reasons, the radicular groove is an ideal plaque trap for promoting periodontal breakdown and pulp necrosis. The significance of the groove in causing periodontal disease is strengthened by the clinical findings, showing that index scores (plaque index, gingival index, periodontal disease index) were greater in teeth with palatal grooves than those with normal morphology (Withers *et al.* 1981). An age factor also exists as patients over 35 years of age were found to have twice the periodontal pocket depth in the area of palatal grooves as that of younger patients (Bacic *et al.* 1990). Therefore, the advanced age of this patient may be one factor in the severity of the associated periodontal problem.

The pulp is also affected by bacteria, which are situated in the radicular groove. Bacteria and their products may enter the pulp through the many accessory foramina and lateral canals situated along the floor or side walls of the groove (Gao *et al*. 1989). Another route of bacteria invasion to the pulp is via the exposed dentinal tubules on the side of groove where surface resorption as a result of inflammatory processes may occur (Gao *et al*. 1989). The resulting pulpal pathosis may warrant endodontic therapy, and occasionally, it is the endodontist who may be presented with the first opportunity to diagnose the radicular groove pathology.

It is also possible that a severe periodontal defect may be secondary to endodontic involvement as bacteria originating from the infected root canal system may extend into the apical base of the fissure and progress coronally. Thus, the entire length of the defect may become a source of chronic inflammation, leading to periodontal breakdown (Simon *et al*. 1971). However, such a hypothesis does not apply in this case as the patient did not describe any injury nor had the teeth been subjected to any restoration. Therefore, pulp necrosis was probably as a result of the apical extension of the buccal groove and possible multiple communications between the floor of the groove and the root canal system. When pulp necrosis developed, the lesion became self-sustaining by the injurious substances emanating from the root canal system.

Diagnosis of a radicular groove is not always easy. This is because the defect may manifest itself with symptoms of true periodontal disease, e.g. a periodontal abscess, or it may be expressed as a true endodontic problem, e.g. acute pulpitis, while in other cases, it may appear as a combined endodontic–periodontic problem. Differential diagnosis must include a long-standing crack on the crown or a vertical root fracture. However, vertical root fracture of a sound central incisor is rare. The final diagnosis is greatly aided by the detection of the notch in the tooth's crown. It should be pointed out that it is not easy to detect this notch as it may be hidden below the gingival margin or by plaque.

The prognosis of teeth with radicular grooves depends on the severity of the periodontal problem, accessibility of the defect and the type of groove (shallow or deep, short or long; Kerezoudis & Siskos 1998). In relatively shallow grooves, the following treatment modalities have been proposed: (i) surgical removal of the granulation tissue and local irritants (Everett & Kramer 1972, Holem 1978, Ramirez 1984); (ii) a gingivectomy or apically repositioned flap (Lee *et al*. 1968); (iii) surgical exposure and flattening of the groove by grinding with a high-speed diamond drill or fine stone, with or without application of guided-tissue regeneration techniques (Rankow & Krasner 1996, Kerezoudis & Siskos 1998); (iv) placing an amalgam restoration in the groove (Lee *et al*. 1968, Simon *et al*. 1971) and (v) orthodontic extrusion of the tooth.

To enhance periodontal attachment on the denuded root dentine, enamel matrix proteins were used during periodontal surgery. This novel treatment is based on research findings showing that enamel-related proteins from the epithelial root sheath are involved in the formation of acellular cementum (Slavkin 1976), and that an enamel matrix-like material is formed on the root surface prior to cementum formation (Lindskog 1982). In animal experiments, it was found that local application of enamel matrix derivatives (e.g. amelogenin) on surgically exposed denuded root dentine induced a marked regeneration of acellular extrinsic fibre cementum, which was firmly attached to the underlying dentine as well as the regeneration of periodontal ligament and alveolar bone (Hammastrom *et al*. 1997). These research findings are further supported by clinical findings showing that application of a commercial product (Emdogain), containing enamel-matrix derivatives in intrabony defects, increased the radiographic bone level as well as clinical attachment (Heijl 1997).

Emdogain has been used in four additional cases over the last 2 years in teeth having radicular palatal grooves within the same clinic. The product was applied using the same protocol described here. The rate of healing of the surgical site was good and the radiographic bone regeneration was rapid and impressive without any signs of external root resorption. Long-term follow up is, however, required.

Conclusions

- Deep radicular grooves can predispose to pulp necrosis and the establishment of combined endodontic–periodontal lesions.
- Evaluation of clinical signs and appropriate diagnostic tests are of paramount importance in order to prevent incorrect diagnosis and treatment.
- Endodontists must be capable of performing advanced periodontal regeneration techniques during endodontic surgery.

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